DATA REDUCTION AND ANALYSIS OF ISEE MAGNETOMETER EXPERIMENT
Contract No. NAS5-25772

C.T. Russell
Institute of Geophysics and Planetary Physics
University of California, Los Angeles
Los Angeles, California 90024

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16. Abstract

This report, which is the eleventh quarterly report for NASA contract NAS5-25772, outlines progress in the reduction and analysis of ISEE-1 and -2 magnetometer data during the third quarter of 1982. Basic magnetic field data have now been reduced for ISEE-1 through 9 January 1980 and for ISEE-2 from launch through 7 November 1980. Technical efforts this quarter concentrated on reducing of large volumes of data, increasing the sophistication of our interactive analysis programs and transferring the capability of doing correlational analyses from the University main computer to our mini-computer system.

Research efforts included studies of the up and downstream turbulence associated with interplanetary shocks, including an exhaustive study of methods of determining shock normals; studies of the similarities and differences in laminar and quasi-laminar shock structure, with current emphasis on the associated up and downstream turbulence; further studies of the distributions of flux transfer events; studies of field aligned currents in the near tail; and studies of substorm dynamics in the magnetotail.

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1. INTRODUCTION

This is the eleventh quarterly report for NASA contract NAS5-25772, "Data reduction and analysis of ISEE magnetometer experiment." This investigation consists of reducing and analyzing magnetic field data from the ISEE-1 and -2 spacecraft which were launched in October 1977 and continue to operate. Tasks are separated into data reduction and dissemination, programming or software development, and research efforts and scientific reporting. The report also includes a staff list and assessment of current problems.

2. DATA REDUCTION AND DISSEMINATION

DATA POOL (24 hour summary plots)

Data Processed:

ISEE-1 Magnetic field: Launch - 31 December 1981.

ISEE-3 Magnetic field (s/c coordinates): Launch - 31 December 1981.

ISEE-3 Magnetic field (GSM): Launch - September 1981.

ISEE-3 Solar wind parameters: Launch - 12 January 1980.

Data microfiched and submitted to NSSDC:

ISEE-1 Magnetic field: Launch - 8 August 1981.

ISEE-3 Magnetic field (s/c): Launch - 21 June 1981.

ISEE-3 Magnetic field (GSM): Launch - 12 January 1980.

ISEE-3 Solar wind parameters: Launch - 12 January 1980.

MAGNETIC FIELD

Production listings: 24 hour summary plots of 64 second average data and standard deviations; 1 hour plots of 4 second average data

Data processed:

ISEE-1 Launch - 9 January 1980

ISEE-2 Launch - 7 November 1980

Data microfiched and submitted to NSSDC (24 hour plots only)

ISEE-1 Launch - December 1979

ISEE-2 Launch - December 1978

ATTITUDE ORBIT

I. Parameter listings

Data processed:

ISEE-1 Launch - Orbit 660

ISEE-2 Launch - Orbit 660

II. Orbit plots (12 projections/orbit)

Data processed:

ISEE-1 Launch - Orbit 723

ISEE-2 Launch - Orbit 723

Data microfiched and submitted to NSSDC:

ISEE-1 Launch - 6 June 1980

ISEE-2 Launch - 6 June 1980

III. Conjugate point maps

Data processed:

ISEE-1 Launch - October 1979

ISEE-2 Launch - Orbit 519

Data microfiched and submitted to NSSDC:

ISEE-1 Launch - October 1979

MISCELLANEOUS

I. IMP-7 trajectory plots: September 1972 - September 1978 microfiched and submitted to NSSDC.

II. IMP-8 trajectory plots: October 1973 - September 1980 microfiched and submitted to NSSDC.

III. Magnetopause crossings: ISEE-1 and -2 4 second average plots for crossings in 1977 and 1978 microfiched and submitted to NSSDC.

IV. Bow shocks: ISEE-2 4 second average plots for shocks of 1977, 1978 and 1979 microfiched and submitted to NSSDC.

A magnetic tape containing ISEE-1 and ISEE-2 high resolution magnetic field data for 53 bow shock crossings has been prepared and submitted to NSSDC.

V. Interplanetary shocks: ISEE-1 and -3 24 hour data pool plots for Ed Smith's list of shocks seen by ISEE-3 in 1979 have been microfiched and distributed.

ISEE-1, -2 and -3 24 hour data pool plots and ISEE-1 4 second plots for shocks studied at the Type II radio burst workshop, Paris, August 1981, have been microfiched and distributed.

VI. Special data requests: During this quarter we also filled special individual data requests for other investigators including Cattell, Lanzerotti, McCormac, Tanskanen, Schwartz, K. Anderson, Scudder, Gosling, Barnes, Rostoker, Hones, Mobius and Smith.

3. SOFTWARE DEVELOPMENT

We have continued to refine and expand our interactive analysis programs, TANAL and BANAL. TANAL now exists in an expert version which is much quicker, and a filtering segment has been added to BANAL.

4. RESEARCH EFFORTS

Studies at UCLA focused on interplanetary shocks, laminar and quasi-laminar bow shocks, the magnetopause and flux transfer events. Further progress in our study of interplanetary shocks required that we determine the shock normals as accurately as possible, and we conducted an exhaustive study of the methods generally used in such determinations in order to meet this need. The normals determined through this study were then very helpful in helping us to understand the turbulence associated with the shocks, and its relation to shock structure.

The theoretical study of the electron anisotropy which drives the small amplitude 1 Hz upstream waves has been written up and submitted for publication.

Our shock structure studies have been expanded to include a set of quasi-laminar as well as laminar bow shocks and surveys of the up and downstream waves associated with each class of shocks have been completed.

Study of the distribution of flux transfer events continues. We have already established that FTE's occur all across the dayside magnetopause, but that their polarizations are reversed in the northern and southern hemispheres. The evolving orbit covers different latitudes on the magnetopause each year. In the data examined to date (until the end of 1980) we have yet to reach as southern a latitude as the initial northernly latitudes sampled in 1977. Thus the southern FTE's are not as fully developed as the original northern FTE's.

5. SCIENTIFIC REPORTING

Papers focusing on ISEE magnetometer data which appeared in press this quarter included:

Greenstadt, E.W., M.M. Hoppe and C.T. Russell, Large-amplitude magnetic variations in quasi-parallel shocks: Correlation lengths measured by ISEE-1 and -2, Geophys. Res. Lett., 9, 781-784, 1982.

Livesey, W.A., C.F. Kennel and C.T. Russell, ISEE-1 and -2 observations of magnetic field strength overshoots in quasi-perpendicular bow shocks, Geophys. Res. Lett., 9, 1037-1040, 1982.

Papers using magnetometer data in an auxiliary role included:

Cattell, C.A. and F.S. Mozer, Electric fields measured by ISEE-1 within and near the neutral sheet during quiet and active times, Geophys. Res. Lett., 9, 1041-1044, 1982.

Daly, P.W. and T.A. Fritz, Trapped electron distributions on open magnetic field lines, J. Geophys. Res., 87, 6081-6088, 1982.

Formisano, V., Measurement of the potential drop across the earth's collisionless bow shock, Geophys. Res. Lett., 9, 1033-1036, 1982.

Lennartson, W. and R.D. Sharp, A comparison of the 0.1-17 kev/e ion composition in the near equatorial magnetosphere between quiet and disturbed times, J. Geophys. Res., 87, 6109-6120, 1982.

Paschmann, G., N. Sckopke, S.J. Bame and J.T. Gosling, Observations of gyrating ions in the foot of the nearly perpendicular bow shock, Geophys. Res. Lett., 9, 881-884, 1982.

Scholer, M., P.W. Daly, G. Paschmann and T.A. Fritz, Field line topology determined by energetic particles during a possible magnetopause reconnection event, J. Geophys. Res., 87, 6073-6080, 1982.

Tsurutani, B.J.E., J. Smith, R.R. Anderson, K.W. Ogilvie, J.D. Scudder, D.N. Baker and S.J. Bame, Lion roars and nonoscillatory drift mirror waves in the magnetosheath, J. Geophys. Res., 87, 6060-6072, 1982.

6. STAFF

During the third quarter of CY 1982 the following people worked on the magnetometer data.

Programming	Job Title	Percent Time
Neal Cline	Senior programmer	25%
Koji Yamasaki	Programmer	100%
Randy Warniers	Programmer	50%

Processing	Job Title	Percent Time
Harry Herbert	Data Processing Production Coordinator	50%
Bruce Rezin	Data Management Assistant	30%
Edson Smith	Coder (student)	50%
Eric Greenfield	Coder (student)	50%
Hsiao	Coder (student)	50%
Chen	Coder (student)	50%
Analysis	**Job Title**	**Percent Time**
M. Hoppe	Asst. Res. Geophys.	100%
J. Berchem	Res. Assoc.	100%
T. Kelly	Grad Student	50%
B. Livesey	Grad Student	0%
D. Winterhalter	Grad Student	0%
R. Walker	Assoc. Res. Geophys.	0%
R. McPherron	Co-I	0%
M. Kivelson	Co-I	0%
C. Russell	PI	10%

N.B. Inclusion in the list at 0% indicates useful contributions to the project while being paid by other contracts or grants.

7. PROBLEMS

Our greatest frustration continues to be our inability to simultaneously satisfy demands for large amounts of raw data processing, new software development, application of available software in scientific analysis and support of other investigators.

Many of the requests which we get from other groups are for data which we have not yet processed, whose special production is an inefficient expensive operation

which ties up staff and machine time ordinarily dedicated to regular production. The addition of a number of work-study students to our staff (a temporarily available fix) has helped increase our production rate up to 7 satellite months of data processed this quarter. This processing rate has been achieved by using our new staff to run the machine almost continuously.

We have talked to Hewlett-Packard about ways in which to remedy this problem, because it is clear that with our present machine, whose CPU is being used close to 90% of the time, we cannot expect to catch up with our backlog of unprocessed data. With funds from the State of California we have added a memory board to the system, which has helped. We still need a new tape drive, but even then the rate of catch up would still be quite slow. The clearest solution to the problem would be the new CPU which Hewlett-Packard expects to have ready in December, which will be 2 1/2 times faster than our present unit. It will be comparable in price to our present CPU, and thus we calculate that about a $40K investment will be necessary in order to allow us to process all the available data. Even then it would take about two years to process the backlog.